MARTIN COMPANY

GEMINI

LAUNCH VEHICLE ACCEPTANCE

SPECIFICATION

Martin Specification MB-1049

Dated 17 April 1963

Contract No. AF04(695)-88
Priority DX-A2

Authorization: AFSSD Letters SSVLE/Lt. Col. Gardner/William B. Fried, dated 17 April 1963 and SSVLE/Lt. Col. Gardner/William B. Fried, dated 24 April 1963

Released by: R. E. Bauman

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Contract Technical Requirements
GEMINI PROGRAM

MARTIN COMPANY
Division of the Martin-Marietta Corporation
Baltimore 3, Maryland

Manufacturer's Federal Supply Code 38597

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ACCEPTANCE SPECIFICATION

1.0 SCOPE

1.1 General.- This specification establishes the basic acceptance criteria and requirements for the Gemini Launch Vehicle, including requirements for supporting documentation prior to and at the time of acceptance, and general requirements for the subsystem functional verification and Combined Systems Acceptance Tests.

1.2 Intended Use.- This specification shall be used by the Procuring Activity and the Contractor as the document defining the requirements for Procuring Activity acceptance of the Gemini Launch Vehicle.

2.0 APPLICABLE DOCUMENTS

2.1 General.- The following documents of the issued date shown, except drawings, form a part of this specification to the extent specified herein. In the case of drawings, the latest revisions shall be applicable. In case of conflict, in this specification and any other referenced document, the requirements of this specification shall govern.

2.1.1 Military Specifications.- None

2.1.2 Contractor Specifications.-

MB-1047	Gemini Launch Vehicle Model Specification, dated 9 April 1963
MB-1042	Gemini Launch Vehicle System Test Specification, dated 18 August 1962
MB-1041	Integrated Documentation Requirements Specification Gemini Launch Vehicle System, dated 15 June 1962

2.1.3 Other Publications.-

U. S. Air Force Bulletin NR-520	Calibration & Certification of Measuring and Testing Equipment dated 17 May 1960

2.1.4 Contractor Drawings.-

424-1020002	Launch Vehicle Acceptance TS
424-191/VTF	Launch Vehicle Acceptance TP
424-1116003	GLV Stage Separation System AGE Req.&TS
424-575/VTF	Ordnance System Functional Verification TP

2.1.4 Contractor Drawings.- (Continued)

424-1116004	GLV Range Safety System TS
424-475/VTF	MISTRAM RSS Functional Verification TP
424-585/VFF	Command Control System Functional Verification TP
424-1112003	Guidance & Flight Control AGE Req. & TS
424-385/VTF	Guidance System Functional Verification TP
424-975/VTF	Flight Control System Functional Verification TP
424-1163000	GLV Airborne Hydraulic System TS
424-977/VTF	Hydraulic System Functional Verification TP
424-1165000	Airborne Instrumentation TS
424-486/VTF	Airborne Instrumentation Functional Verification TP
424-1167001	Electrical/Command Control System TS
424-585/VTF	Command Control System Functional Verification TP
424-1167000	Airborne Electrical System TS
424-675/VTF	Electrical System Functional Verification TP
424-1119003	Airborne MDS AGE Req. & TS
424-375/VTF	MDS Functional Verification TP
424-1161000	A/B Propulsion System Checkout & Firing TS
424-290/VTF	Propulsion Stage I Engine Functional Verification TP
424-190/VTF	Launch Vehicle Air Conditioning Functional Verification TP
424-291/VTF	Propulsion Stage II Engine Functional Verification TP

2.1.4 Contractor Drawings.- (Continued)

424-1167002 424-486/VTF	Electrical/Telemetry System TS A/B Instrumentation Functional Verification TP
424-1167003 424-194/VTF	EEI LV System Compatibility TS EEI LV System Compatibility TP

3.0 REQUIREMENTS

3.1 General.- The acceptance of the Gemini Launch Vehicle by the Procuring Activity shall be predicated upon the presentation by the Contractor of a Launch Vehicle in accordance with both the drawings and the issue of Specification MB-1047 applicable at the time of acceptance. Acceptance of the Gemini Launch Vehicle shall take place at the Contractor's Vertical Test Fixture and shall be evidenced by the execution of form DD-250 after compliance with the requirements of this specification is demonstrated. Initiation of general launch vehicle acceptance testing shall be construed as beginning with initiation of subsystem functional verification tests conducted in compliance with the applicable specification listed in MB-1041.

3.2 Acceptance Criteria.-

3.2.1 Documentation Available Prior to Acceptance.- The following documentation shall be made available prior to the start of the Contractor conducted acceptance test program upon the request of the Procuring Activity or as provided in Specification MB-1041:

a. System Schematics - All existing system and subsystem schematic drawings available thirty (30) days prior to the start of acceptance testing.

b. Drawings - Engineering drawings - assembly and installation.

c. Test Specifications - All applicable test specifications.

3.2.1 Documentation Available Prior to Acceptance.- (Continued)

d. Test Procedures - Test procedures for all subsystem functional verification tests and the Combined System Acceptance Test.

e. Test Plans - All applicable plans.

f. Test Records - Records of all Phase I component qualification tests, including certification that all Phase I testing has been satisfactorily completed; records of all Phase II component qualification testing to the extent completed at that time; and records of other launch vehicle subsystem and component tests, and AGE tests, including certification of satisfactory completion of all tests during horizontal and vertical testing for acceptance of the launch vehicle.

g. Associate Contractor Documents - Associate Contractor documents, as supplied to the Contractor with the Government-furnished property.

h. Calibration Data - Certification of calibration of all test equipment used in the subsystem functional verification tests, and all records of pre-installation calibration/checkout of end instruments and subsystems.

i. Vertical Test Fixture - Certification that the Vertical Test Fixture GSTP's have been successfully conducted.

3.2.2 Documentation Available at the time of Acceptance.- The following documentation shall be available to Procuring Activity personnel at the start of the Contractor conducted acceptance test program:

a. Drawing List - An index of launch vehicle assembly, installation and procurement drawings, with all drawings and schematics updated and available for withdrawal and review. Drawing Change Notices shall be available for review or shall have been incorporated in the appropriate drawings when reasonable elapsed time has permitted incorporation.

b. Contract Specifications - All applicable contract specifications.

c. Test Specifications - All applicable test specifications.

d. Test Procedures - All applicable test procedures.

e. Qualification Status - The qualification status for all equipment, Phase I and Phase II, including certification that all qualification testing has been completed in accordance with Martin Specification MB-1042.

f. Quality Control Logs - Quality Control logs which record inspections performed, accumulated component operating time, test certifications, failure records, configuration and accountability records, maintenance records, critical component records, and certification that there are no shortages.

3.2.2 Documentation Available at the time of Acceptance.- (Continued)

g. Specification Compliance Log - Log indicating compliance with applicable paragraphs of contract specifications.

h. Change Certification Sheets - Sheets listing the CCN's and ECP's which show deviations from compliance with test procedures and test specifications.

i. Calibration Data - Certification of calibration of all test equipment used in the launch vehicle subsystem functional verification tests and the Combined Systems Acceptance Test.

j. Production Support Data - Data from incoming inspections and production tests which have been conducted on launch vehicle components provided by suppliers of the Contractor.

k. Excluded Equipment List - All excluded equipment shall be identified thirty (30) days prior to start of acceptance testing together with justification for exclusion.

l. Launch Vehicle History - A log documenting the history of the Launch Vehicle to time of Combined Systems Acceptance Test.

m. Launch Vehicle Configuration Identification - Identification of the configuration of the launch vehicle at the time of Combined Systems Acceptance Testing.

3.2.3 Examination of Product.- Inspection of each complete Launch Vehicle shall be conducted to assure compliance with applicable drawings and specifications. Such inspection shall include requirements of mechanical measurements, completeness, finish, freedom from damage, identification of components, and maintenance of the required standard of workmanship.

3.2.4 Test Equipment Calibration.- Equipment used for measuring and testing shall be calibrated with measurement standards, the calibration of which is traceable to the National Bureau of Standards as required by paragraph 4 of U. S. Air Force Bulletin NR-520. Intervals of calibration shall be established by the Contractor in accordance with paragraph 5 of NR-520.

3.2.5 Test Environment.- The launch vehicle subsystem functional verification tests and the Combined Systems Acceptance Test shall be conducted under normal ambient environmental conditions within the following limits:

a. Elevation - Sea level to 10,000 feet

b. Temperature - Ambient ranging from 32°F to 100°F

c. Humidity - Ambient

3.2.6 Witnessing of Tests.- Witnessing of launch vehicle subsystem functional verification tests and the Combined Systems Acceptance Test shall be required by the Procuring Activity or its designated representative. The Contractor shall notify the Procuring Activity thirty (30) days prior to the start of the subsystem functional verification test program and the Combined Systems Acceptance test. The Procuring Activity

3.2.6 Witnessing of Tests.- (Continued)

shall be notified three (3) working days in advance of the start of specific subsystem functional verification tests and the Combined Systems Acceptance Test.

3.2.7 Recording of Test Results.- Procedures shall be established to record the results of the Launch Vehicle subsystem functional verification tests and the Combined Systems Acceptance Test. Such records shall be retained and be available for examination.

3.2.8 Documents for Acceptance Records.-

a. Acceptance Summary Report - This report will contain the following information:

(1) Launch Vehicle configuration identification.

(2) Contract number and contract changes.

(3) Certification by the Contractor that the Launch Vehicle meets the provisions of the applicable specifications.

(4) List of items excluded from further tests after installation in the launch vehicle.

(5) Launch Vehicle history.

(6) Certification that all tests required for launch vehicle acceptance have been satisfactorily completed.

3.2.8 Documents for Acceptance Records.- (Continued)

b. Certified Specification Compliance Log - This log will contain data, specification references, and a certification by the Contractor to show that applicable Contract Specification requirements, including acceptance test requirements, have been successfully completed.

3.3 Combined Systems Acceptance Test (CSAT).- The Combined Systems Acceptance Test will be conducted in accordance with the Launch Vehicle Acceptance Test Specification and Test Procedure, Martin Drawings 424-1020002 and 424-191/VTF respectively. The CSAT will be conducted as two separate simulated flight sequences; one, a normal sequence of the launch vehicle subsystems operating under the conditions of simulated flight; and the other, a demonstration of countdown and simulated flight including a switch-over to the redundant Launch Vehicle systems and completion of the simulated flight with the redundant systems.

3.3.1 Pre-test Requirements and Conditions.-

3.3.1.1 CSAT Prerequisites.- The Combined Systems Acceptance Test shall not be started until the following conditions have been satisfied:

a. All Phase I qualification testing, as specified in Martin Specification MB-1042, shall be completed prior to conducting the CSAT.

b. Successful completion of the subsystem functional verification tests in accordance with the current issue of the following test specifications and test procedures:

3.3.1.1.b CSAT Prerequisites.- (Continued)

424-1116003 424-575/VTF	GLV Stage Separation System AGE Req. & TS Ordnance System Functional Verification TP
424-1116004 424-475/VTF 424-585/VTF	GLV Range Safety System TS MISTRAM RSS Functional Verification TP Command Control System Functional Verification TP
424-1112003 424-385/VTF 424-975/VTF	Guidance & Flight Control AGE Req. & TS Guidance System Functional Verification TP Flight Control System Functional Verification TP
424-1163000 424-977/VTF	GLV Airborne Hydraulic System TS Hydraulic System Functional Verification TP
424-1165000 424-486/VTF	Airborne Instrumentation TS Airborne Instrumentation Functional Verification TP
424-1167001 424-585/VTF	Electrical Command Control System TS Command Control System Functional Verification TP
424-1167000 424-675/VTF	Airborne Electrical System TS Electrical System Functional Verification TP
424-1119003 424-375/VTF	Airborne MDS AGE Req. & TS MDS Functional Verification TP
424-1161000 424-290/VTF	A/B Propulsion System Checkout & Firing TS Propulsion Stage I Engine Functional Verification TP
424-190/VTF	Launch Vehicle Air Conditioning Function Verification TP
424-291/VTF	Propulsion Stage II Engine Functional Verification TP
424-1167002 424-486/VTF	Electrical Telemetry System TS A/B Instrumentation Functional Verification TP

3.3.1.1 CSAT Prerequisites.- (Continued)

c. Calibrations of all test equipment are current.

d. All open items against the launch vehicle appearing on the quality recap sheets have been resolved.

e. Successful completion of EEI testing, for the first launch vehicle only, in accordance with the current issue of EEI Launch Vehicle System Compatibility test specification 424-1167003 and EEI Launch Vehicle System Compatibility Test Procedure 424-194/VTF.

3.3.1.2 Simulators.- Limitations of the vertical test fixture capability and safety considerations will dictate the necessity of functional simulators being used to represent the following items:

a. Spacecraft

b. Engine start, separation and prevalve squibs

c. Destruct initiator and primers

d. Stage I Destruct battery

3.3.1.2 Simulators.- (Continued)

e. Prevalve shorting plugs to simulate prevalves open.

f. Launch Vehicle Battery Adapter cables will be used in place of Auxiliary Power Supply and Instrumentation Power Supply airborne batteries.

3.3.1.3 CSAT/Flight Sequence Similarities.- The Combined Systems Acceptance Test will duplicate the actual flight sequence to the fullest extent possible commensurate with test cell design and Gemini program limitations. The major changes which cause the acceptance test to differ from an actual flight sequence are:

a. No propellants will be loaded.

b. The propellant and pressurization system will not be pressurized.

c. The Stage II engine ablative skirt will not be installed.

d. The test cell AGE will not include all the launch control equipment. The Propellant Control Set, Master Operations Control Set and Launch Vehicle Release Control Set will not be included.

e. Stage I fuel shutdown sensors will be disconnected during sequence 2.

f. Subassembly 1 Thrust Chamber Pressure Sensor switch will be depressurized remotely during sequence 2.

3.3.1.3 CSAT/Flight Sequence Similarities.- (Continued)

g. Requirements for supplementary instrumentation shall be as agreed upon by the Contractor and Procuring Activity. Data will be derived from the AGE only, either by visual indication or integral recorders.

h. All r.f. transmissions, except telemetry, will be closed loop.

3.3.2 Combined Systems Acceptance Test Sequence 1.- Sequence 1 will simulate a countdown and all Launch Vehicle subsystems operating under simulated flight conditions. All subsystems shall be operating; those which have primary and redundant modes of operation shall be operated in their primary mode. When all subsystems, which have been undergoing pre-flight checkout, report a "GO" condition, the countdown shall start. At T-8 minutes, various checks by the Test Call AGE shall commence. At T-0 the Stage I engine switches shall be pressurized simulating engine firing; at T + 0 the "pad" disconnect shall be manually removed starting the flight programmer and simulating lift-off. The progression of events occurring within the Launch Vehicle shall be continuously monitored by the

3.3.2 Combined Systems Acceptance Test Sequence 1.- (Continued) AGE and visually observed. The sequence shall proceed through the roll program and a portion of the pitch program to L.O. +139.5 seconds where the simulated separation of the Stage I from Stage II sequence and Stage I shutdown shall occur. The Stage I engine switches will be depressurized and the Stage I hydraulics pressure dropped. The Stage II engine switches and thrust chamber valves shall be pressurized; the Stage II hydraulic pressure will be brought up and the interstage disconnects for the electrical and instrumentation systems will be pulled, manually. At L.O. +156.16 seconds the flight programmer pitch program will end and the Radio Guidance steering command program shall be initiated from the AGE. The last command of the Radio Guidance System will initiate simulated shutdown of the Stage II engine. The test will end with the arming of the Stage II shutdown sensors at L.O. +322.56 seconds.

3.3.3 Combined Systems Acceptance Test Sequence 2.- The second sequence shall consist of a simulated flight sequence utilizing redundant flight control and hydraulics subsystems; the backup staging timer and the Spacecraft guidance simulator. When all subsystems, which have been undergoing pre-flight checkout, report a "GO" condition the countdown shall start. The Operations from T-5 to T-0 will be essentially the same as sequence 1. At T-0, the airborne systems shall undergo the following changes in operation:

a. The engine thrust chamber valves shall not be operated.

b. The flight programmer shall not be started.

3.3.3 Combined System Acceptance Test Sequence 2.- (Continued)

c. The flight control and hydraulics systems shall be switched to the redundant systems by a simulated malfunction detection system vehicle over-rate signal.

d. Redundant hydraulic power shall be supplied by the hydraulic pumping unit (CP-5001).

e. Shutdown sensors shall be disconnected prior to sequence 2 test.

All other systems shall operate as in sequence 1. An engine gimbaling program shall be initiated from the Spacecraft simulator, approximating the Inertial Guidance System output and replacing the Flight Control Programmer signals. At L.O. +140 seconds the staging backup timer shall arm the thrust chamber pressure switch. Stage I shutdown shall be accomplished by manually depressurizing the Stage I thrust chamber pressure switch. Stage II simulated flight shall continue until Launch Vehicle shutdown and Spacecraft separation are achieved by termination signal from the Inertial Guidance System simulator.

3.3.4 Weight & Balance Test.- A weight and balance test shall be performed on the Launch Vehicle after the CSAT has been completed. Weighing of the Launch Vehicle shall be accomplished to determine the individual weight of Stage I, Stage II and the interstage. Dimensional data shall be obtained for determining the center of gravity with respect to a station line. Stage I, Stage II, and interstage of the launch vehicle shall be weighed to verify the dry weight conditions and center of gravity measurements specified in the Appendices herein.

3.3.5 Requirements Peculiar to Each Launch Vehicle.- An appendix to this specification shall be prepared for each launch vehicle for the purpose of identifying each launch vehicle by serial number, the applicable issue of Specification MB-1047, applicable dry weight conditions, center of gravity measurements, etc. Each appendix shall be submitted to the Procuring Activity for information thirty (30) days prior to the start of Combined System Acceptance Testing.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 General.- The Quality Assurance responsibility for Gemini Launch Vehicle Acceptance shall include pre-CSAT inspection, verification and approval of test results, historical data review and configuration control. Quality Assurance will extend to include pre-shipping inspection and final approval for delivery to AMR.

4.1.1 Pre-CSAT Inspection.-

a. Vertical Test Fixture Inspection - The Vertical Test Fixture shall be inspected for readiness to accept the launch vehicle. Construction of and installations in the Vertical Test Fixture shall be inspected, and it shall be verified that all the work required by subcontractors has been properly accomplished. Verification of construction and/or installations shall include steel work, pressurized gas systems, hydraulic systems, cable installations, cable trays, racks, consoles, junction boxes and allied VTF supporting facilities.

4.1.1 Pre-CSAT Inspection.- (Continued)

b. Vertical Test Fixture Checkout.- The installed systems in the Vertical Test Fixture will be checked utilizing GSTP's. Performance of these GSTP's will be verified to make certain that systems function in accordance with these procedures.

c. Erection Operation.- The Launch Vehicle erection into the vertical test fixture shall be monitored and compliance with applicable erection procedures shall be verified. Proof loading of all slings, harnesses, cables, straps and other handling equipment used during Launch Vehicle erection shall be verified prior to use.

d. Launch Vehicle Alignment.- Launch Vehicle alignment procedures will be verified and all readings will be determined.

e. Servicing of Equipment.- All servicing and maintenance shall be monitored and records kept in log books.

f. Desiccant Control.- All equipments requiring desiccants will be inspected on a periodic basis and desiccants removed as needed. Log book records will be kept on desiccant control.

4.1.1 Pre-CSAT Inspection.- (Continued)

g. Mechanical & Electrical Interfaces - The launch vehicle splice and mating surfaces shall be checked to the latest applicable drawings. These surfaces shall be checked for cleanliness to see that they are void of foreign material. All staging connectors will be checked for proper installation, mating, continuity and separation function.

h. Equipment Failures - All equipment failures will be tagged with a Trouble Report and Withholding Tag to assure that a complete explanation is provided.

i. Equipment Interchange or Modification - Equipment replacements will be documented and monitored. All modifications effective against the launch vehicle and the AGE in the Vertical Test Fixture will be monitored, inspected and documented in the appropriate log books. Unaccomplished modification will be recapped in appropriate logs as open items until they are accomplished.

j. Review and Verification of Documentation - Documentation concerning the Gemini Launch Vehicle and associated AGE will be gathered, reviewed and verified for adequacy, accuracy, and completeness. All documentation concerning unscheduled work, special tests,

4.1.1 Pre-CSAT Inspection.- (Continued)

j. Review and Verification of Documentation - (Continued) design changes, calibrations, maintenance and servicing will be controlled via Work Authorization Orders, Test Procedures and Log Books. Documentation will be reviewed on a continued basis.

4.1.2 CSAT Verification and Approval During Test.-

a. Launch Vehicle Test Procedures - All Launch Vehicle test procedures will be reviewed and approved by Quality Engineering. They will be checked to insure that they are complete and have the latest revisions incorporated. All tests will be monitored in conjunction with the test procedures. Verification of a satisfactory test shall be indicated by an approval stamp in the test procedure for the requirements that have been complied with.

b. Test Results - Test results will be monitored and analyzed in conjunction with Engineering by the following modes:

(1) Visual witnessing of vehicle system functions.

(2) Visual witnessing of test "read outs" on AGE consoles.

(3) Monitoring GIE recordings.

4.1.2 CSAT Verification and Approval During Test.- (Continued)

c. Testing - In the event that the test results of the CSAT are inconclusive and a re-run of the complete test or a segment of the test is required, quality control of the launch vehicle will be maintained so that its test configuration remains unchanged until retesting is completed.

4.1.3 Post CSAT Operation.-

a. Test Results Review - Test results will be reviewed with Engineering to assure that all requirements of the Combined Systems Acceptance Test specification have been met.

b. Modifications after CSAT - Modifications accomplished after the CSAT will be monitored and documented in the appropriate log books. Where such modifications require a change to equipment previously tested during CSAT, the retesting required shall be recapped in the launch vehicle log.

c. Dismantling and Handling - Removal of the launch vehicle from the Vertical Test Fixture shall be monitored to assure that it is accomplished in accordance with the removal procedure.

d. Weight and Balance - The launch vehicle will be weighed in sections: Stage I, Stage II and the interstage section. The equipment used for weighing shall be

4.1.3 Post CSAT Operation.- (Continued)

d. Weight and Balance - (Continued)

checked to assure that it is within calibration date. It shall be verified that the equipment used to lift the launch vehicle sections have been proof loaded. The launch vehicle weighings shall be monitored and readings will be documented in appropriate log books.

4.1.4 Pre-Shipping Operation.- Prior to shipping, all the log books and associated documentation will be reviewed to insure that the records are complete and current. All modifications and test procedures will be reviewed for completeness. Open items will be recapped prior to shipping the launch vehicle.

5.0 PREPARATION FOR DELIVERY - Not applicable.

6.0 NOTES

6.1 Definitions.-

a. Procuring Activity - Space Systems Division; Air Force Command, United States Air Force, Los Angeles 45, California.

b. Contractor - Martin Company, Division of the Martin-Marietta Corporation, Baltimore 3, Maryland.